

**WHAT IS CLAIMED IS:**

1. A solid state device comprising:

a first material;

5 a second material;

a barrier layer formed between the first material and the second material to prevent diffusion between the first material and the second material, the barrier layer includes a metal form of at least one of Ru and Re.

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2. The device as recited in claim 1, wherein the metal form includes a hexagonal close packed structure.

3. The device as recited in claim 1, wherein the  
15 first material is a dielectric and the second material is a metal.

4. The device as recited in claim 1, wherein the  
first material is a conductor and the second material is a  
20 metal.

5. The device as recited in claim 1, wherein the first material includes copper.

5 6. The device as recited in claim 1, wherein the metal form includes a single metallic phase in a temperature range of between about 300 degrees C and about 550 degrees C.

10 7. The device as recited in claim 1, wherein the metal form includes a single metallic phase in a temperature range of between about 300 degrees C and about 900 degrees C.

15 8. The device as recited in claim 1, wherein device is a semiconductor device and the first material includes a semiconductor material.

20 9. The device as recited in claim 1, wherein the barrier layer includes a thickness of 700 Angstroms or

less.

10. A method for fabricating a semiconductor device,  
comprising the steps of:

5       providing a structure having a first material formed  
thereon;

          forming a barrier layer over the first material  
wherein the barrier layer comprises at least one of Re and  
Ru in a metallic phase; and

10       forming a second material over the barrier layer to  
prevent diffusion between the first and second materials.

11. The method as recited in claim 10, wherein the  
metallic phase includes a hexagonal close packed structure.

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12. The method as recited in claim 10, wherein the  
first material is a dielectric and the second material is a  
metal.

20       13. The method as recited in claim 10, wherein the

first material is a conductor and the second material is a metal.

14. The method as recited in claim 10, wherein the  
5 first material includes copper.

15. The method as recited in claim 10, wherein the  
step of forming a barrier layer includes depositing the  
barrier layer at a temperature below 400 degrees C.

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16. The method as recited in claim 10, wherein the  
step of forming a barrier layer includes depositing the  
barrier layer at a temperature of about 300 degrees C.

15 17. The method as recited in claim 10, wherein the  
step of forming a barrier layer includes depositing the  
barrier layer by employing a chemical vapor deposition  
process.

20 18. The method as recited in claim 10, wherein the

step of forming a barrier layer includes employing a metal carbonyl as a precursor.

19. The method as recited in claim 18, wherein the  
5 metal carbonyl includes at least one of  $\text{Ru}_3(\text{CO})_{12}$  and  
 $\text{Re}_2(\text{CO})_{10}$

20. The method as recited in claim 10, wherein the  
step of forming a barrier layer includes depositing the  
10 barrier layer at a thickness of 700 Angstroms or less.